

Claims

[c1] 1. A method for controlling an automatic transmission in a vehicle, the vehicle including an engine, a brake pedal, and an accelerator pedal, the method selectively providing automatic engine braking for the vehicle, the transmission having a plurality of shift points, including upshift points for defining when the transmission is allowed to shift to a higher gear, and downshift points for defining when the transmission is allowed to shift to a lower gear, each of the shift points being based on vehicle speed and accelerator pedal position, the method comprising:

determining when automatic engine braking is desired; increasing at least some of the upshift points when it is determined that automatic engine braking is desired, the increase in each of the at least some upshift points effecting an increase in the vehicle speed at which a corresponding shift to a higher gear is allowed; and automatically downshifting the transmission to a lower gear, thereby providing engine braking for the vehicle, when it is determined that automatic engine braking is desired and at least one vehicle condition matches a corresponding predetermined vehicle condition, and

wherein the transmission can be automatically downshifted when the brake pedal is engaged, and when the brake pedal is disengaged.

- [c2] 2. The method of claim 1, wherein the at least one vehicle condition matches a corresponding predetermined vehicle condition when the vehicle speed drops below a first downshift point.
- [c3] 3. The method of claim 1, further comprising:
 - setting a vehicle acceleration threshold;
 - delaying subsequent transmission downshifts by a predetermined amount of time after a transmission downshift has occurred; and
 - wherein the at least one vehicle condition matches a corresponding predetermined vehicle condition when vehicle acceleration is above the vehicle acceleration threshold, the predetermined amount of time has passed since a previous transmission downshift, and the vehicle speed is below a predetermined speed, the predetermined speed being based on a transmission gear immediately below a current transmission gear.
- [c4] 4. The method of claim 1, further comprising inhibiting transmission upshifts when it is determined that automatic engine braking is desired, and the accelerator pedal is not engaged.

- [c5] 5. The method of claim 1, further comprising increasing the number of transmission gears in which engine braking is enabled when it is determined that automatic engine braking is desired.
- [c6] 6. The method of claim 1, wherein determining when automatic engine braking is desired includes determining the position of a manually operated switch.
- [c7] 7. The method of claim 1, wherein determining when automatic engine braking is desired includes determining whether a set of vehicle conditions are satisfied, the set of vehicle conditions including the vehicle traveling downhill, the vehicle speed increasing, and the accelerator pedal not engaged.
- [c8] 8. The method of claim 1, further comprising:
 - delaying transmission upshifts when it is determined that automatic engine braking is desired, each of the transmission upshifts being delayed by a predetermined amount of time after the vehicle speed has reached a corresponding upshift point;
 - determining whether the engine is producing positive torque in a current transmission gear; and
 - automatically upshifting the transmission to a next higher gear when it is determined that automatic engine

braking is desired, the accelerator pedal is engaged, and the predetermined amount of time has passed since the vehicle speed reached an upshift point.

[c9] 9. The method of claim 8, further comprising:

determining whether the engine can produce a predetermined amount of negative torque in a higher transmission gear when it is determined that the engine is not producing positive torque in the current transmission gear; and

automatically upshifting the transmission to a next higher gear when it is determined that automatic engine braking is desired, the accelerator pedal is engaged, and it is determined that the engine can produce the predetermined amount of negative torque in the next higher gear.

[c10] 10. A method for controlling an automatic transmission in a vehicle, the vehicle including an engine, an accelerator pedal, a brake pedal, and first and second brake pedal sensors, the method selectively providing automatic engine braking for the vehicle, the transmission having a plurality of shift points, including upshift points for defining when the transmission is allowed to shift to a higher gear, and downshift points for defining when the transmission is allowed to shift to a lower gear, each of the shift points being based on vehicle speed and ac-

celerator pedal position, the method comprising:
determining when automatic engine braking for the vehicle is desired;
increasing at least some of the upshift points when it is determined that automatic engine braking is desired, the increase in each of the at least some upshift points effecting an increase in the vehicle speed at which a corresponding shift to a higher gear is allowed;
determining whether the first or second brake sensor indicates that the brake pedal is engaged;
automatically downshifting the transmission to a lower gear when it is determined that automatic engine braking is desired and at least one vehicle condition matches a corresponding predetermined vehicle condition.

- [c11] 11. The method of claim 10, wherein the at least one vehicle condition matches a corresponding predetermined vehicle condition when the brake pedal is not engaged, the accelerator pedal is not engaged, and vehicle acceleration is above a predetermined positive acceleration.
- [c12] 12. The method of claim 10, wherein the at least one vehicle condition matches a corresponding predetermined vehicle condition when the accelerator pedal is not engaged, the first brake sensor indicates that the brake pedal is engaged, and vehicle acceleration is positive.

- [c13] 13. The method of claim 10, wherein the at least one vehicle condition matches a corresponding predetermined vehicle condition when the accelerator pedal is not engaged, the second brake sensor indicates that the brake pedal is engaged, and vehicle acceleration is above a predetermined negative acceleration.
- [c14] 14. The method of claim 10, wherein the first brake sensor is configured to detect brake pedal position, and the second brake sensor is configured to detect brake pedal pressure.
- [c15] 15. The method of claim 10, further comprising:
 - setting a vehicle acceleration threshold based on the vehicle speed and inputs from the first and second brake sensors;
 - delaying subsequent transmission downshifts by a predetermined amount of time after a transmission downshift has occurred; and
 - wherein the at least one vehicle condition matches a corresponding predetermined vehicle condition when the vehicle acceleration is above the vehicle acceleration threshold, the predetermined amount of time has passed since a previous transmission downshift, and the vehicle speed is below a predetermined speed, the predetermined speed being based on a transmission gear immediately below a current transmission gear.

[c16] 16. A system for controlling an automatic transmission in a vehicle, the vehicle including an engine, a brake pedal, first and second brake pedal sensors, an accelerator pedal, and an accelerator pedal sensor, the system selectively providing at least first and second shift modes, the second shift mode selectively providing automatic engine braking for the vehicle, the transmission having a plurality of shift points including upshift points for defining when the transmission is allowed to shift to a higher gear, and downshift points for defining when the transmission is allowed to shift to a lower gear, each of the shift points being based on vehicle speed and accelerator pedal position, the system comprising:
a controller in communication with the transmission, the engine, the first and second brake pedal sensors, and the accelerator pedal sensor, the controller being configured to determine whether automatic engine braking is desired, and to select the first shift mode when it is determined that automatic engine braking is not desired, and to select the second shift mode when it is determined that automatic engine braking is desired.

[c17] 17. The system of claim 16, wherein the controller is further configured to increase at least some of the upshift points when the second shift mode is selected, the increase in each of the at least some upshift points ef-

fecting an increase in the vehicle speed at which a corresponding shift to a higher gear is allowed, the controller being further configured to automatically downshift the transmission to a lower gear, thereby providing engine braking for the vehicle, when the second shift mode is selected and at least one vehicle condition matches a corresponding predetermined vehicle condition.

[c18] 18. The system of claim 17, wherein the controller is further configured to set a vehicle acceleration threshold and to delay subsequent transmission downshifts when the second shift mode is selected, the vehicle acceleration threshold being based on the vehicle speed and inputs from the first and second brake sensors, the subsequent transmission downshifts being delayed by a predetermined amount of time after a transmission downshift has occurred; and

wherein the at least one vehicle condition matches a corresponding predetermined vehicle condition when vehicle acceleration is above the vehicle acceleration threshold, the predetermined amount of time has passed since a previous transmission downshift, and the vehicle speed is below a predetermined speed, the predetermined speed being based on a transmission gear immediately below a current transmission gear.

[c19] 19. The system of claim 17, wherein the controller is further configured to delay transmission upshifts and to determine whether the engine is producing positive torque in a current transmission gear, when the second shift mode is selected, each of the transmission upshifts being delayed by a predetermined amount of time after the vehicle speed has reached a corresponding upshift point, the controller being further configured to automatically upshift the transmission to a next higher gear when the second shift mode is selected, the accelerator pedal is engaged, and the predetermined amount of time has passed since the vehicle speed reached an upshift point.

[c20] 20. The system of claim 17, wherein the controller is further configured to determine whether the engine can produce a predetermined amount of negative torque in a higher transmission gear when it is determined that the engine is not producing positive torque in the current transmission gear, and to automatically upshift the transmission to a next higher gear when the second shift mode is selected, the accelerator pedal is engaged, and it is determined that the engine can produce the predetermined amount of negative torque in the next higher gear.